Job composition, gender and income inequality in the long run: Sweden, 1870–1950*

Erik Bengtsson† Jakob Molinder‡

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Abstract

The contemporary literature in labour economics has, in canonical studies like Goos and Manning (2007) and Autor and Dorn (2013) demonstrated the importance of the job composition of the labour market for income inequality, political polarization and other important outcomes. Roughly speaking, a labour market's jobs supply has been found to change in three ways: upgrading (a general improvement of the jobs available), downgrading (the reverse), or polarization (the best and the worst jobs growing in importance). We provide a historical study of this phenomenon, using the case of Sweden from 1870 to 1950.

Our investigation speaks to three literatures: the literature on upgrading and polarization of labour markets; research on long-run income inequality; and the literature on the gender pay gap. We document that during a period of high and stable inequality, 1870 to 1900, job growth in Sweden from 1870 to 1900 was more intense in high-pay jobs than in low-pay ones. This was driven by the shedding of low- and unpaid agricultural labour. 1900 to 1920 saw little consistent pattern on the aggregate level but on the sectoral level there was quite drastic change, well-remunerated agricultural occupations shrinking, but adding well-paid jobs in industry and services. 1920 to 1950 again saw little overall change but growth of well-paid jobs in industry and agriculture. Comparing the job structure (the "quantity effect" of changing employment shares on the income distribution) with occupational income ratios (the "price effect), we show that income ratios, between salaried workers and blue-collar workers and between farmers and blue-collar workers, shrank between 1870 and 1900, and again between 1920 and 1950. The income of the average woman relative to the average man improved from about 45 percent in the 1870-1920 period to about 65 percent in 1940 and 1950. The timing of the gender equalization was similar to the United States and Germany, but the equalization was more forceful (Goldin, 1992; Lindert and Williamson, 2016; Neef, 2024). The improvement was related to the restructuring of the labour market, with the decline of low-pay groups such as family assistants in agriculture, and agricultural workers.

Keywords: *incomes, inequality, Sweden, structural transformation, economic history*

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†Department of Economic History, Lund University; erik.bengtsson@ekh.lu.se

‡Department of Economic History, Uppsala University; jakob.molinder@ekhist.uu.se

1 Introduction

In the contemporary setting, researchers and policymakers alike are highly concerned with what kinds of jobs are created in our (IT-driven, automation-driven) economy: are labour markets in the affluent world polarizing, creating a pattern of "lousy and lovely jobs"? (Goos and Manning, 2007; Autor and Dorn, 2013). And if so, what kind of social and political consequences does this entail? One specific concern is the connection between job polarization and economic inequality: so for example Acemoglu and Restrepo (2022) argue that more than half of the relative decline of wages of routine workers since the 1980s has been caused by increased automation, decreasing demand for such routine labour.In this way, the literature on labour market change is intrinsically connected to the literature on economic inequality (Piketty, 2014; Piketty et al., 2018).

This paper takes this debate, on labour market change and especially its connection to income inequality, to a historical setting: Sweden 1870 to 1950. Like other OECD countries, Sweden during this period underwent significant structural transformation: a decline in the share employed in agriculture, a decline in the share employed in family businesses (agricultural or not), and rapid income growth (Caselli and Coleman, 2001; Ruggles, 2015). In Sweden, GDP per capita was 4.96 times higher in 1950 than it had been in 1870, and the share employed in agriculture shrank from 67 to 21 percent (Schön and Krantz, 2015, Tables I, VIII). The combination of rapid industrialization and income growth raises the question of the evolution of the job structure during such episodes of structural change. The two previous studies to reach the furthest back in history while studying jobs polarization or upgrading, Bárány and Siegel (2018) and Gustavsson (2017), "only" go back to the 1950s. They both find that the jobs structure was polarizing – in the United States and in Sweden respectively – already in the 1950s and 1960s, contrary to current views of job polarization as driven by computers. In contrast to these studies, we analyze a historical period marked mostly by the upgrading of the job structure.[1]

Our analysis requires two pieces of information: the structure of the labour force in terms of the distribution of people between various occupations, and the income of each occupation. To identify the structure of employment, we use the Population Census from each decade, augmented for under-reporting of women's jobs (Molinder, 2023) and other problems. For the purposes of our analysis, we define "occupation" as a combination of class – capital owner, working owner, salary-earner, wage-earner – and sector: agriculture, and various subsectors of industry and services. To identify the income of each occupation, we build on a newly assembled 1 % sample of income taxpayers every tenth year (Bengtsson et al., 2025). These extensive micro data (N= 232 000) provide a fine-grained view of occupation-specific incomes, for everyone who earned enough to pay the income tax – roughly the top 10 percent of income earners at the beginning of our period, 22 percent in 1910, 46 percent in 1920, and 72 percent in 1950. For the tax payers we have genuine individual level data to build our occupational incomes; for non-filers we use occupation-specific estimates built on contemporary social surveys and agrarian surveys, wage statistics, and previous research.

[1] Previous studies of industrialization – such as Katz and Margo (2013) for the United States since 1850 – have documented de-skilling or the "hollowing out" of the jobs structure in manufacturing, the latter meaning the growth of low-skill operatives and high-skill white collar jobs with a decline in middle-skill artisan jobs. In relation to such industry-focused studies, we show that the inclusion of agriculture and services makes a big difference to the pattern of job growth.

We document several new facts about the evolution of labour markets and income inequality in the 1870 to 1950 period. Overall, the 1870 to 1890 period sees neither clear polarization nor upgrading, while the 1890-1910, 1910-1930 and 1930-1950 period in increasing measure are periods of job upgrading. Dividing this process by sector, we show that upgrading after 1890 was driven by industry and services, while the agricultural sector shed jobs throughout the income structure (from labourers to farmers) but especially concentrated into mid-level jobs in 1890-1910 and 1910-1930, and at the bottom of the income structure in the 1930s and 1940s. We document that fully one fifth of the Swedish labour force in the late 1800s were occupied as unpaid family assistants on farms (wives, adult children) and another fifth as agricultural labourers. Shedding these jobs, to a high degree replacing them with farm machinery, upgraded the job structure immensely. Given the similarity with other industrializing economies such as the United States on this point (e.g., Ruggles, 2015; Ngai et al., 2024), the results for Sweden here can probably also speak to the experience of other industrializing economies in the late 1800s and early 1900s. Looking at the movement of major occupations (such as farmers with farms of various sizes) throughout the income distribution over time, we also show that the approach, which compares employment shares in year t and year t+1 considering the income structure of year t, gives an unduly pessimistic view of the job upgrading during the period, as the once high-income positions of farmers decreased at the same time as they shrank

Given the strongly gendered character of labour markets in the late 1800s and early 1900s (Ruggles, 2015; Stanfors and Goldscheider, 2017; Ngai et al., 2024), and the widening of womens' employment opportunities during our time period (Goldin, 1992), it is crucial to consider the gender aspect of economic restructuring. Dividing the process by gender, we show that the labour market opportunities of women contributed to job upgrading 1910-1930 and 1950, corresponding to the expansion of clerical and manufacturing jobs available to women documented for this period by Goldin (1992) and several later scholars (Neef, 2024; Bengtsson and Molinder, 2024; Heikkuri, 2024; Vidart, 2024). Calculating the average woman's income as a share of the average man, we find that this ratio had little clear trend 1870-1920 (the ratio grew by five percentage points in 50 years) but great improvement from 1920 to 1940, from 45 percent to almost 70 percent. Inequality for women was, however, quite high, shrinking significantly only after 1950.

In a further analysis, we analyze the implications of the jobs upgrading for aggregate income inequality. Treating our occupational structure with occupation-specific income as a "social table" (Erfurth et al., 2026), we calculate the Gini coefficient of incomes, and decompose its changes into two components: the "quantity effect" (effects of the growth and disappearance of certain jobs), and the "price effect" (effects of changing relative wages) on the income distribution. This has not been done in a historical setting before, as far as we know.[2] The Gini coefficient declined in two clear time periods: from 1870 to 1910 (from 0.50 to 0.40), and from 1920 to 1950 (from 0.44 to 0.26). The equalization was, somewhat surprising given the great degree of structural transformation evidenced by the job upgrading analysis, mostly driven by income effects rather than composition effects; about four-fifths of the decrease in the Gini in the various subperiods was driven by income effects.

[2]Whereas for example Gray et al., 2024 have described the job transformation of the US since 1900 – but without incomes. Also Fiszbein et al., 2020. Atack et al., 2023 have wages for manufacturing 1820–1940.

2 Theory and previous research

2.1 Mapping the job structure

In our main approach, we follow the contemporary economics literature on jobs polarization and upgrading. Goos and Manning (2007) in their seminal paper on the UK since the 1970s divided the jobs structure of the 1970s into five quintiles, from the 20 percent with the lowest income to the 20 percent with the highest income, and calculated the net jobs growth since then by quintile. A job is defined as the combination of an occupation and a sector, with studies of the contemporary US often using about 300 occupation-sector combinations.[3] Following the literature, we define *job polarization* as a development where the most low-paid jobs and most high-paid jobs grow while the middle is hollowed out; *job upgrading* as a development where the low-paid jobs shrink in importance and the high-paid jobs grow; and *job downgrading* as the reverse of upgrading.

The job polarization literature arose in dialogue with the skilled bias technological change (SBTC) school of explaining the growth of wage inequality in the industrialized economies since the 1970s. The motivation of the study of Goos and Manning (2007) was to contrast two views of the post-1970s labour markets in the industrialized world. Both views focus on the implications of computerization for the labour market, but with different specific mechanisms. In the SBTC view, the demand for high-skilled jobs has grown and demand for low-skilled jobs has declined with computerization, while in the alternate view the effect of computerization on labour demand was non-linear, letting computers and information and communication technologies more generally replacing routine (medium-skilled, medium-paid) jobs, while both low-paid and high-paid jobs have grown in importance. In the first view, skill-biased technological change should have led both to growing skill differentials, and to growth of high-skill jobs; in the second view, the effect on the job structure (and wage differentials) is non-linear. (See also Autor and Dorn, 2013.)

On the demand side of the labour market, consumer preference is identified as the major force behind the reshuffling of jobs. In canonical studies like Autor and Dorn (2013), the consumer preference for variety means that even if prices for e.g. agricultural goods fall, this does not mean that consumers will reallocate spending to those goods. (See also Bessen, 2019 on the long run and Comin et al., 2020 on the post-1980-context.)

There are both important similarities and differences between our historical investigation and the contemporary debate. The most obvious difference is that in the post-1970s debate, technological change is at the very center of the discussion. The counterpart in studies within economic history is the study of the implementation of specific technologies: if computerization of production is the main driver in analyses like Autor and Dorn (2013), electrification is the main focus for historical studies such as Gray (2013); Damron (2025), while there also are studies of specific technologies in specific sectors: Feigenbaum and Gross (2024) on the automation of telephone sector in the interwar period, and Ager et al. (2023) and Forslund et al. (2025) on the spread of milking machines in agriculture in the late 1800s. Our approach is different and, we would

[3] For a discussion of the occupation-approach and a comparison with a worker-approach see Hunt and Nunn (2022).

argue, complementary to the technology-driven approach. We do not study a specific technology but rather the overall evolution. As we will see, agriculture, industry and services all played important roles in the restructuring of the Swedish labour market over the 80 year-period we study here. Here we differ from contemporary studies: in our context, the role of agriculture and the shift out of agriculture is crucial, while in most post-1980 analyses, agricultural employees are dropped from the analysis altogether (e.g. Bárány and Siegel, 2018)

Another difference is that education is much less central in our investigation than in the contemporary debate. In the contemporary discussion (e.g., Autor and Dorn, 2013), educational divides, especially between college-educated and non-college-educated, are crucial to the discussions, and especially through the differential demand effects of technology on workers of various skill levels. We do not have educational information for the individuals in our data and cannot investigate the effects by education level; it is also the case that in Sweden between 1870 and 1950, overall the education level was very low: in 1930, only one percent of the workforce had a college degree and only two percent an upper high school diploma, *studentexamen* (SOU, 1935). Thus, most of the restructuring observed here took place among people without high school diplomas.

If technology and education are less central to our analysis than in the contemporary debate, two other dimensions are more prominent: the rural-urban dimension, and gender. The sectoral decomposition (agriculture–industry–services) is central to our approach, and we also decompose the job market evolution by rural/urban residence. Given persistent gender labour market segmentation, structural change has different implications for women and men (Dwyer, 2013; Ngai et al., 2024), something that we also will consider.

2.2 Effects of jobs change on the income distribution

The income distribution is a central outcome variable in the job polarization literature. Goos and Manning (2007) rounded off their article by discussing the implications of polarization for the income distribution, arguing that the polarization perspective contributed to explaining the growing income gaps in post-1970s Britain between the 90th percentile and the 50th percentile, while the loss of ground for the 10th percentile workers compared to the median, at the same time as more 10th percentile jobs were created, must have indicated factors at play outside of labour demand, such as the weakening of trade unions.

Also in later studies like Acemoglu and Restrepo (2022) polarization matters greatly for income inequality; Acemoglu and Restrepo argue that "between 50 % and 70 % of changes in the U.S. wage structure over the last four decades are accounted for by relative wage declines of worker groups specialized in routine tasks in industries experiencing rapid automation."

In our case, the Swedish job structure transformed almost completely over the 1870 to 1950 period. The share employed in agriculture shrank from 67 to 21 percent, the job structure diversified, and the country urbanized. There are no clear predictions from the previous literature on what this should mean for the income distribution: in a classical Kuznetsian (1955) perspective, the decreasing importance of family farms and increasing importance of a polarized secondary sector (factory workers and capitalists) should increase inequality, but we could also view Fordist

jobs growth in industry as equality-enhancing.

2.3 Gender income gaps

Goldin (1992) pioneered the research on the long-run incomes of women compared to men. In the light of the highly gendered division of labour, Goldin highlighted how periods of expansion for jobs and sectors available to women facilitated shrinking income income gaps, this occurring in the United States in the early 1800s, at the turn of the twentieth century, and after the 1980s. Neef (2024) provides a comparative study for Germany.

An important difference in our approach compare to that of Svensson (2003); Neef (2024) and others is that they focus on pay gaps – income gaps conditional on having a job. We take a more comprehensive view, studying incomes all over, including unpaid family assistants who were a large part of the labour force in the late 1800s (cf. Ruggles, 2015).

2.4 Swedish context

The Swedish labour market in the 1870s was dominated by agriculture: more than two thirds of employment was in the primary sector (Schön and Krantz, 2015). It was also a relatively poor economy, with a large share of its labour force absorbed by low-productive family farms (Bengtsson et al., 2025). A very large share of the labour force was employed as unpaid family assistants in agriculture: farmers' wives and adult children working for no or little pay, a pattern typical of the period (Ruggles, 2015; Ngai et al., 2024). Over the decades after 1870, Sweden underwent rapid industrialization, the industrial share of GDP growing from 14 percent in 1870 to 25 percent in 1900 and 35 percent in 1950 (Schön, 2014; Schön and Krantz, 2015, Table III). In the classic hypothesis of Kuznets (1955), industrialization gave rise to higher income inequality as incomes in this sector were also higher (increasing between-sector inequality) and more unequally distributed (increasing within-sector inequality) than those in agriculture. However, there is also reason to believe that manufacturing rather has a capacity to create well-paid jobs for the low-skilled, thus strengthening egalitarianism (Rodrik, 2016). We will provide a breakdown of the job creation process 1870–1950 and its connection to income inequality, and to do this we build on the contemporary literature in labour economics.

3 Data and method

3.1 Incomes: a 1 % taxation sample

Our data work begun with sampling 1 % of income taxpayers every tenth year 1870-1920 and 0.5 % in 1940 and 1950. For 1930, the Population Census uniquely includes income information and we get the incomes from the Census (Riksarkivet, 2025). The taxation sample encompasses about 232 000 original tax returns, with the sample size varying between c. 6 000 in 1870 and 1880 to c. 74 000 in 1950. We have previously used these data in a study of the income distribution in Sweden (Bengtsson et al., 2025).

The source is the income tax (*inkomstbevillning*) introduced in 1862 which took 1 percent of incomes (a flat rate) and encompassed in principle anyone who did not mainly live off farming; farmers instead paid a property tax (*egendomsbevillning*) (Hedlund-Nyström, 1972). Wage earners with low incomes did not have to pay the *inkomstbevillning*: the income threshold to pay tax was originally an annual income of 400 kr, which was raised to 500 kr in 1884, 600 kr in 1903 and 1200 kr in the late 1940s (Gustafsson and Johansson, 2003, p. 194). The income data in the taxation lengths are quite reliable. The numbers are often rounded to the closest hundred or ten and we know that there is some under-reporting, but careful comparisons of the taxation lengths and other sources (corporate wage rolls and so on) show that the discrepancies are small (e.g., Öhngren, 1974; Olsson, 1972).

The taxation lists contain the following information which we have excerpted: municipality, place (town/rural municipality), occupational title, name (from which we code gender), and income of three types: labour, capital, and self-employment. The estimates of the size of the non-income-taxpaying groups have been estimated using the Censuses, our other major source.

For farmers and for those workers with incomes below the threshold, we have estimated incomes based on social surveys, wage studies and other sources (see Bengtsson et al. (2025), Appendix B, for extensive discussion). Fortunately, there is a rich set of sources, such as contemporary farm surveys (Nanneson, 1916, 1923; SCB, 1955), concerned studies of labourers' living standards (e.g Kommerskollegium, 1911), and source-based studies of wages (Prado, 2010; Lundh and Olsson, 2011)

3.2 Job structure: the Censuses

To get at the job structure of Sweden from 1870 to 1950, we use the Population Censuses. These were essentially carried out every tenth year. They contain an occupational title for all adults and these data have been used extensively for research for example on social mobility (Berger et al., 2023) and on the effects of emigration and re-migration on occupational status (Ejermo et al., 2025).

To analyze the occupational structure of the population, we have coded each occupation as a unique combination of three characteristics: class (essentially owner, working owner, salary-earner or wage-earner), broad sector (agriculture, industry, service or unclassified) and specific sector.[4] Specific sector is for industry, for example, 9 different sectors: Mining; Metal and engineering; Quarrying; Wood; Pulp, paper and printing; Food, beverage and tobacco; Textile, clothing, leather and hair; Chemical and rubber; and Building and construction, gas and waterworks.[5] Thus, an "occupation" as we define it here is a combination of four class groups (more

[4]The set of occupational titles in the original taxation data is obviously very diverse. In the 1950 sample we have 11 016 unique occupations entered, including all the different spellings and abbreviations. We homogenize them to make them comparable and the analysis tractable, and also to make the individual-level income data from the taxation data comparable to the group-level incomes imputed for non-taxpayers.

[5]More specifically, the class schedule encompasses the following groups: Capital owners; Large farmers; Middling farmers; Small farmers; Semi-landless; Working owners, artisans etc; Salary-earners; and Wage-earners. The three farmer groups and the semi-landless are obviously only found in the agricultural sector, but the other categories can be found in any sector, so that the category of Capital owners in agriculture corresponds to estate owners. In the tertiary sector there are 7 specific subsectors: Trade; Transport and communication; Insurance and banking; Personal and social services; Education and professions; Administration and military; Domestic services. Within the broad agricultural sector we only apply 2 subsectors: Agriculture and forestry; and Fishing.

in agriculture) and 18 subsectors: nine in industry, seven in services, and two in agriculture. In each case, they are further separated into rural/urban and male/female.

It is important to note that we take a comprehensive view of what an "occupation" is. Given the great importance of the labour of farmers' wives (and farmers' adult children staying on the farm as cheap labour) especially at the beginning of our period, we see it as crucial to include family assistants in agriculture as an occupation. It is a fact that without the labour of this group, the incomes registered by farmers would not have been possible. (For contemporary evidence based on detailed farm accounts and time use surveys, see Nanneson, 1916, 1923; for discussions in agrarian history, see Flygare and Isacson, 2003.) Here we follow recent approaches in demography and macroeconomics (Ruggles, 2015; Ngai et al., 2024). Following this view, we code wives and children of farmers, with no other stated occupation, as formally unpaid family assistants in agriculture.[6]

Another source critical problem of the Census is the use of non-descript titles such as the generic "worker" or "labourer" (*arbetare*, *grovarbetare*) or "salaried employee" (*tjänsteman*). These cannot be placed in a specific economic sector, and as we will show, these groups were rather large in our period, 7-10 percent of the labour force in the early years. This means that in our sectoral analysis, beyond the three-sector division (agriculture-industry-services) we will also include a "sector unknown" category.

4 The employment structure and jobs upgrading, 1870–1950

For our analysis of the evolution of the occupational structure, we focus on four sub-periods of equal length: 1870 to 1890, 1890 to 1910, 1910 to 1930, and 1930 to 1950. A first diagnosis of the job structure of the period is to simply collate the most common jobs and their places in the income distribution. This is done in a series of tables in the Appendix (Table A.1, A.2, and further). The main takeaway is that Sweden in these years was a poor economy, with the occupational structure of a developing country.[7]

The first obvious fact is that a large part of the labour force was employed as unpaid family assistants in agriculture: in 1870, 19 percent, in 1910, still 18 percent, and in 1930, 9.5 percent. This can be compared to the shares reported for the United States by Ruggles (2015, pp. 1801–1804), around 10 percent for men 1870–1910 and then a decrease; around 50 percent for women 1870–1910 and then a steep decrease to around 20 percent in 1950. This was the case for wives as well as adult children staying at home, helping out at the family farm. Given the patriarchal

[6] Johansson (1996) and Jonsson (2006) have, for the early twentieth century, compared household survey data with Census statements to show the discrepancy between the stereotypical titles and the actual labour patterns; it is clear that the Census hides some of the work done. For more expansive discussion of this issue see Stanfors and Goldscheider (2017), Lindström and Ågren (2025) and, in the Norwegian context, Modalsli (2025). The source critical problems specifically for women are discussed in Molinder (2023).

[7] The job structure is rather similar to that identified by Gómez León and Gabbuti (2025) in their study of Italy, using social tables for 1901 to 1950. They have a narrower conceptualization of the population at study so exclude, as far as we understand, many of the unpaid family assistants, but the bottom quintile is quite poor in their social table too, consisting "mainly of female wage-earners in agriculture and textile factories." Like us, they identify male wage earners in heavy industry as relatively privileged – in their case, included in the P50–P70 group which they label "the lower-middle class" (Gómez León and Gabbuti, 2025, p. 9).

structure of Swedish farms in this time period (cf. Morell, 2001; Flygare and Isacson, 2003; see also Nanneson, 1916 for contemporary discussion), we have allocated only a minor share of the family farm's income to these unpaid family assistants. This pessimism, which we believe is warranted given the agrarian history and the accounts of contemporary agronomists such as Nanneson (1916, 1923), the recorded income of the family assistants is low and they end up in the lowest quintile of incomes. The other huge and quite poor group is that of the agricultural laborers: about 21.5 percent of the labour force in 1870, 13 percent in 1910, and 10.5 percent in 1930. The huge size of these two groups means that to make our quintile-based analysis of the job restructuring tractable, we have introduced a variation to the incomes of these two groups before making the calculations. We have used a "jitter" approach, varying the group-specific incomes by +- 25 *kronor*, corresponding to about 12-13 percent of the income of these groups in 1870.[8]

Having said that, we can move on to the analysis of the jobs structure. Was the Swedish labour market in the 1870 to 1950 period marked by job upgrading, downgrading, or polarization? Figure 1 shows that 1870 to 1890 saw little of either. There was some expansion of quintile 4 occupations, corresponding to declines in quintiles 2, 3 and 4, but the changes were minor, in no place of the distribution reaching the level of a 5 percentage point expansion or contraction of the occupations belonging to a certain quintile in the base year, here 1870. 1890 to 1910 saw more change, with quintile 3 jobs shrinking while quintile 2 and, especially, 4 grew. The 1910 to 1930 period was yet more dramatic, with a pattern of upgrading: declines in quintiles 1 and 3, growth in quintiles 2, 4, and 5. This upgrading continued and became more unambiguous in the 1930 to 1950 subperiod: a heavy decline in quintile 1 jobs and expansion in quintiles 2, 3, and 5.

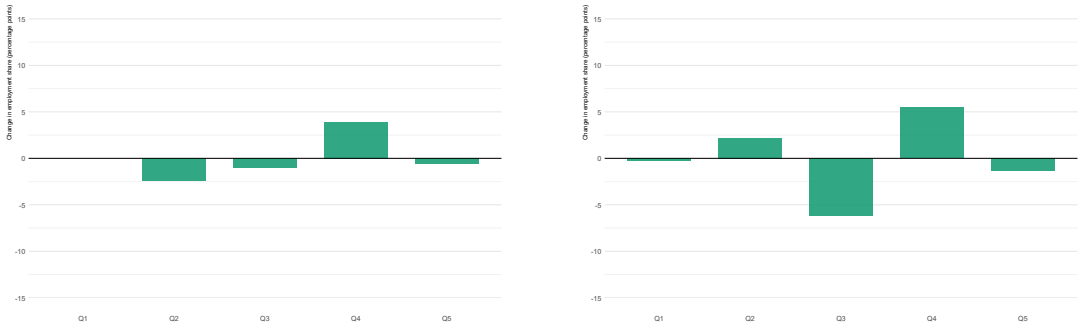
The picture of Figure 1 is still quite anodyne and it is not so easy to interpret what was going on. Given that we know that Sweden was a rapidly growing and industrializing economy throughout the period, it is crucial to consider sector-specific changes. Hence, in Figure 2, the polarization analysis is divided by sector: primary, secondary and tertiary. There is also a final category of jobs that cannot be ascribed to a specific sector; this is especially about the ubiquitous titles of "worker" and "labourer" (*arbetare, grovarbetare*).

Compared to the overall picture in Figure 1, the decomposition is quite revealing. In the 1870 to 1890 period, the agricultural sector is overall shedding jobs, more specifically in quintiles 2, 3, and 4 – but interestingly enough not in quintile 1.[9] The decline in agricultural employment, with its spread across the quintiles, was matched by growth of industrial employment, concentrated in quintile 4. From 1890 to 1910 the decline of agriculture continued, with concentrated declines in quintiles 3 and 5, while industrial jobs contributed especially in quintiles 2-4. there is also a new contribution of the services sector, creating jobs in the top quintile. The 1910 to 1930 sector sees more drastic change: structural change has speeded up and become more complex than the agricultural-to-industrial-substitution of the first subperiod. In the 1910s and 1920s the decline of quintile 1 jobs, so visible already in Figure 1, is revealed to be driven by the

[8] This is not elegant but the introduced variation is small, likely without much direct effect on the estimates, and it does make the estimation of occupational growth by income quintile tractable.

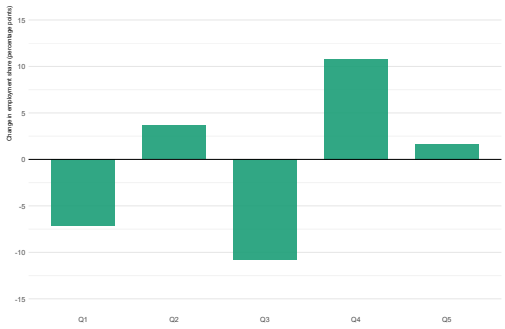
[9] In the decades of 1870, Swedish agriculture underwent rapid transformation. The number of farms grew continously from 1870 until the 1920s, from about 390 000 to about 430 000 farms, but labourers left the sector for the cities and for America. Their labour was replaced by machines. See the discussion in Morell (2001); the number of farms is on page 35.

Figure 1: Jobs polarization or upgrading in Sweden, 1870 to 1950

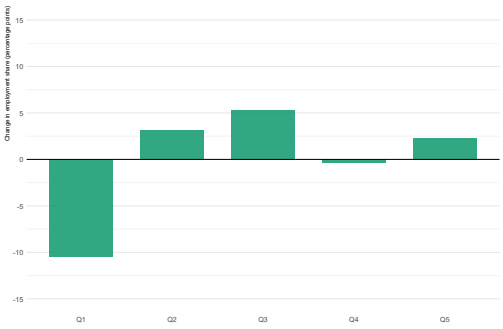


(a) 1870–1890

(b) 1890–1910



(c) 1910–1930



(d) 1930–1950

Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870, 1890, 1910 and 1950, augmented with Census employment information. The 1930 sample builds on the 1930 Census which uniquely includes income information. The calculations build on rolling benchmarks: 1870 is the benchmark for Panel A, 1890 is the benchmark for Panel B, 1910 for Panel C, and 1930 for Panel D. In every case all the jobs in the benchmark year are sorted by average income and divided into five quintiles, from the lowest incomes (quintile 1) to the highest incomes (quintile 5). The y axis in the Figure measures the change in the quintile's (of the benchmark year) share of jobs in the outcome year. Note that for two occupations, family assistants in agriculture and agricultural workers, we have introduced "jittered" income variation to make the analyses tractable for the early years. We have introduced a variation of income of +- 25 *kronor*, which can be compared to the average income of family assistants in 1870 of 190 kronor, and that of agricultural labourers as 198 kronor – see Table A.1.

labourers. The hollowing out of the middle, quintile 3, also that visible in Figure 1, is revealed to be driven by the agricultural sector, most likely driven by the semi-landless agriculturalists and the small farmers. Conversely, it is clear that the upgrading of the workforce – the growth of quintile 4 and 5 jobs – is driven by industry and services. In the final period, 1930 to 1950, there is a clear upgrading of the job composition, with the strong decline of the most low-paid jobs (Q1, -10 percent) being driven by agriculture, and the growth of middle-paid jobs (Q3) driven by agriculture (!) and above all industry, and the top jobs (Q5) driven by services and generic titles of "white collar worker" (*tjänsteman*). The downward pull of Q5 in the final period done by agriculture should also be contexualized: we will show further on that farmers were during this period also dropping down in the occupational income distribution, meaning that the static comparison in panel D of Figure 1 may give an overly negative view of the 1920 to 1950 development.

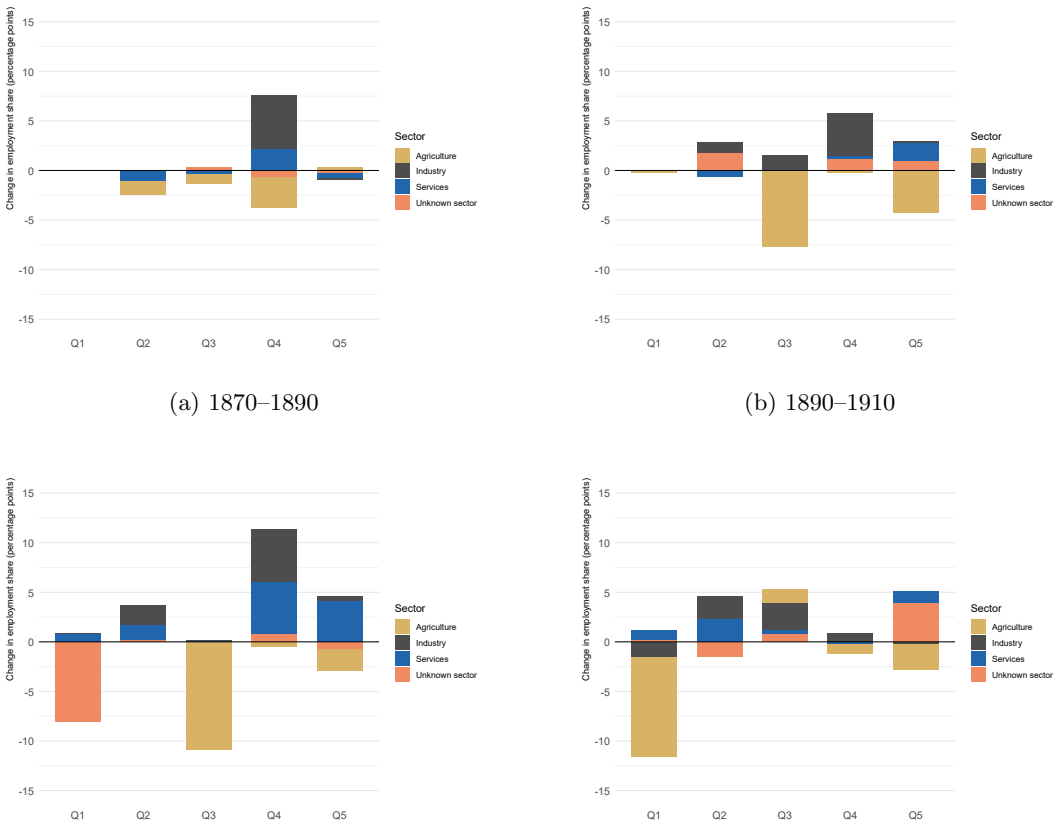
The quite peculiar behaviour of agriculture in Figure 2 opens up for a question of how jobs

move throughout the income distribution over time. This is highlighted in Figure 3. We see for example at medium-size farmers, defined here as 20 hectares or more of arable (See discussion in Bengtsson et al., 2025, Appendix B.) consistently until 1950 are located in the upper quintile of incomes, and even small-scale farmers (2-20 hectares of arable) are there or in quintile 4 until 1940. Other than that, to a high degree the position in the income structure is quite stable, at the same time as the real incomes grow very consistently: in that sense, it appears that the tide did lift all boats. As we have emphasized, real GDP per capita in 1950 was about 5 times as high in 1950 as in 1870, and real income growth was steep for the groups included in Figure 3, such as male workers in the metal working industry or, even, the female domestic servants. (This of course from a very low level in 1870.)

Figure 4 shows that income growth was not completely equally distributed over various groups. In line with previous research based on public salary statistics (Bengtsson and Prado, 2020), the salary-earner to wage-earner differential was extremely steep in the 1870s, and took a fall in the following decades, followed by stability c. 1890-1920 and then another fall. Also the income ratio of mid-size farmers to male metal workers shows that the income growth of manufacturing workers outpaced that of farmers during 1880–1910 as well as 1920 to 1950.

Another way of illustrating the interaction between structural transformation and the income distribution is shown in Figure 5. Here all jobs are ranked on the x-axis after their degree of rurality (that is, the % of persons in the job who live in a rural area) and on the y-axis after the income percentile where the average person in the job is placed. In 1870, 100 percent rural jobs dominated the income structure but they were present all over the structure: from rural wage-earners and family assistants at the bottom of the income distribution, to farmers at the top. Over time, the 100 percent rural jobs shrank – as is visible by the declining size of the dots – and were rather compressed in terms of their place in the income distribution. Conversely, the 100 percent urban jobs were in 1870 concentrated on the higher end of the income distribution, while in 1950 they were all over, from percentile 30 to 95 or so.

Figure 2: Jobs polarization by sector



(a) 1870–1890

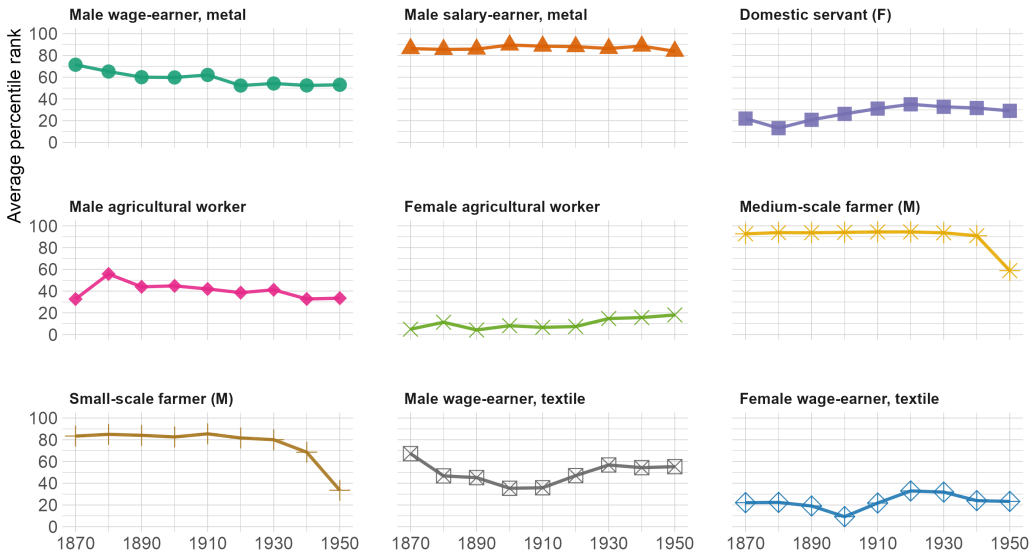
(b) 1890–1910

(c) 1910–1930

(d) 1930–1950

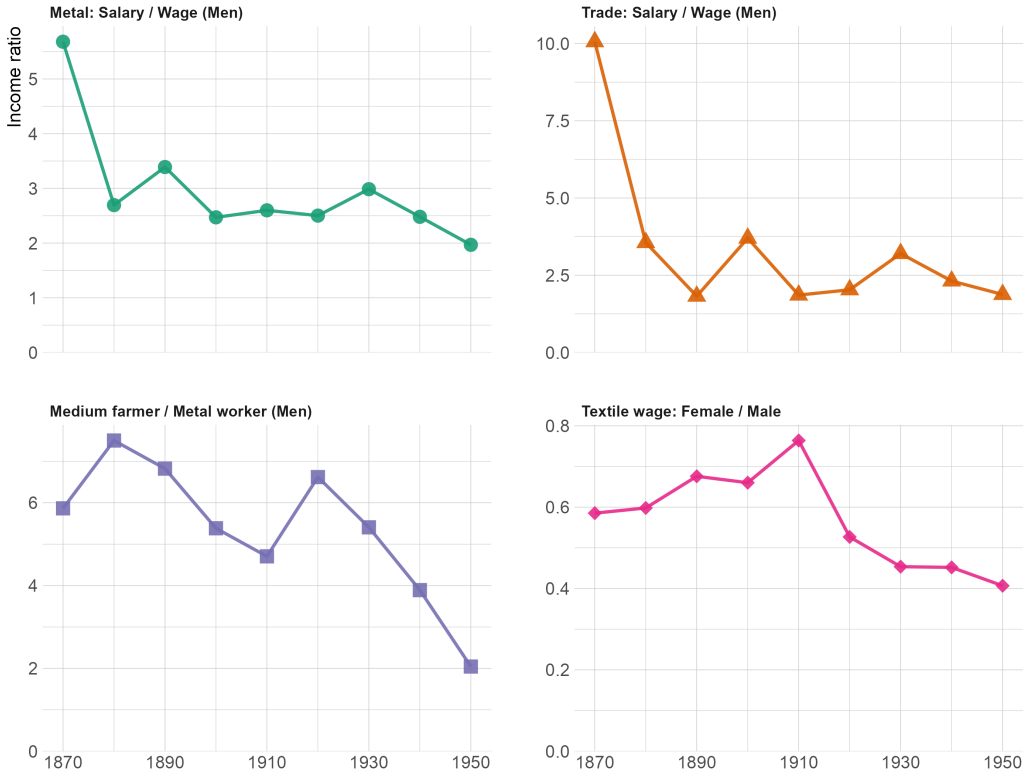
Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870, 1890, 1910 and 1950, augmented with Census employment information. The 1930 sample builds on the 1930 Census which uniquely includes income information. The calculations build on rolling benchmarks: 1870 is the benchmark for Panel A, 1890 is the benchmark for Panel B, 1910 for Panel C, and 1930 for Panel D. In every case all the jobs in the benchmark year are sorted by average income and divided into five quintiles, from the lowest incomes (quintile 1) to the highest incomes (quintile 5). The y axis in the Figure measures the change in the quintile's (of the benchmark year) share of jobs in the outcome year. Note that for two occupations, family assistants in agriculture and agricultural workers, we have introduced "jittered" income variation to make the analyses tractable for the early years. We have introduced a variation of income of +- 25 *kronor*, which can be compared to the average income of family assistants in 1870 of 190 kronor, and that of agricultural labourers as 198 kronor – see Table A.1.

Figure 3: The income ranking of a series of important jobs, 1870 to 1950



Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870-1950 and imputations for non-taxpayers. For discussion of the method see Bengtsson et al. (2025).

Figure 4: Four occupational income differentials



Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870-1950 and imputations for non-taxpayers. For discussion of the method see Bengtsson et al. (2025).

Figure 5: The correlation between degree rural and position in the income distribution for jobs, 1870 to 1950

Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870-1950 and imputations for non-taxpayers. For discussion of the method see Bengtsson et al. (2025).

5 The role of gender

In the discussion of structural change, we have already touched upon the role of gender. The move-out of low-income occupations such as domestic service or family assistant in agriculture disproportionately affected women, so we expect a reduction of the gender income gap to follow from that structural change. Figure 6 shows that this was indeed the case; the average woman's income as a share of the average man rose from around 45 percent in 1870–1890 to above 60 percent in 1940 and 1950, after a temporary decline in 1920 which was a year of great turbulence in the Swedish economy.[10]

The timing of the gender income gap reduction is very similar to those observed in the United States and Germany by Goldin (1992) and Neef (2024). It is also similar to what Svensson (2003) found in his study of wages (note the difference in that we consider also non-wage incomes): in Svensson's data, the two major equalization periods of the twentieth century were 1920 to 1940 and 1960 to 1980. However, the 1920 to 1940 equalization documented in Figure 6 is stronger than those found in Germany and the United States.[11]

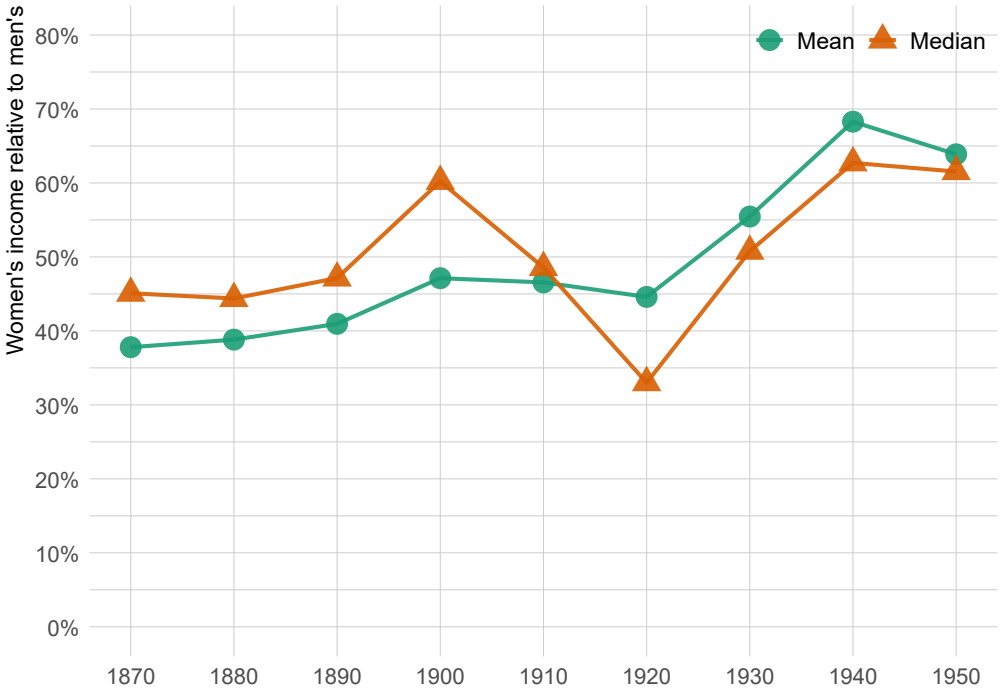
The 1920 to 1940 reduction pay gap reduction was according to Svensson (2003) driven by employment shifts of women, moving into better-paid clerical and administrative jobs, especially in trade and commerce and public services. This accords well with our findings for Stockholm (Bengtsson and Molinder, 2024) but we have not made the corresponding estimates for Sweden as a whole yet.[12]

[10] Rapid inflation during World War One, with a stock market boom, was followed by rapid deflation in the early 1920s. 1920 was still a period of very high and volatile prices, including for example very steep food prices, benefiting farmers.

[11] The level above 60 percent is quite high also in a contemporary context. Neef and Robilliard (2021) find levels around 36 to 44 percent in European countries today.

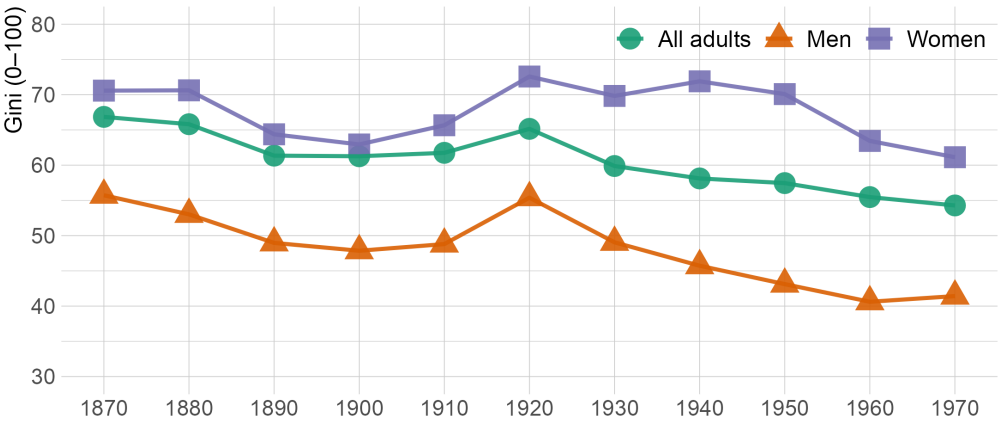
[12] The catch up of women's incomes compared to men roughly correlates with the demographic transition. The total fertility rate was over the nineteenth century 4 to 4.5 children per woman, but it started to fall around 1880 and in the 1920s and 1930s stabilized around 2 to 2.5 (Dribe and Scalone, 2014, p. 431). The explanatory value of the fall in fertility for women's improved economic outcomes (and vice versa) can be discussed (cf. Dribe et al., 2014, p. 136).

Figure 6: Women's incomes as a share of men's



Note: Calculations built on sample of taxpayers 1870, 1880, 1890, 1900, 1910 1920, 1940 and 1950, complemented with imputations for non-filers, and the Census for 1930.

Figure 7: Gini coefficients separately for men and women



Note: Calculations built on sample of taxpayers 1870, 1880, 1890, 1900, 1910 1920, 1940 and 1950, complemented with imputations for non-filers, and the Census for 1930.

6 The evolution of income inequality: price and quantity effects

The labour market approach here can also inform discussions on inequality. As discussed in the contemporary literature by Goos and Manning (2007), Acemoglu and Restrepo (2022) and others, growing income polarization can be driven by polarization of the job structure. If relatively homogenous and relatively well-paid groups shrink while the most low-paid and high-paid groups grow, the polarization of the income structure increases even if the pay ratios (say, between software engineers, manufacturing workers in metal industry, and agricultural workers) do not change. In this section, we decompose changes in income inequality into (a) occupational income changes and (b) shifts in the occupational structure. The latter corresponds directly to the reallocation patterns documented in the polarization analysis.

The crucial aspect is that our data of the occupational structure, with associated incomes, can be seen as a "social table", a type of data often used in historical studies of income inequality (Erfurth et al., 2026). These inequality estimates build on assuming zero inequality within each occupational groups, which is problematic and means that one wants to use as fine-grained a division as possible, but here the point is not the levels of the inequality estimates themselves – even though they should be reasonable compared to estimates building on more comprehensive data – but the feasibility to decompose changes in inequality into "price" (income) and "quantity" effects. Figure 8 shows the Gini coefficients implied by our occupational structure-and-income-data for all benchmark years, 1870 to 1950. A comparison with the much more precise estimates in Bengtsson et al. (2025), who use individual-level data for roughly the top 10 percent of the population 1870-1890, for the top 22 percent in 1910, the top 46 percent in 1920, the top 59 percent in 1940, and the top two thirds in 1950, is reassuring. There we find Gini coefficents between 65 and 70 in 1870 and 1880, a decline to around 60 1890-1910, a slight increase to 1920, and then a decrease again, to about 54 percent in 1950. The trends are very much the same here, but with a more drastic decrease in 1930, 1940 and 1950.

The point is however not to estimate the income distribution but to decompose it into pay ratio effects and occupational structure effects. Let inequality in year t be written as

$$G_t = G(y_t, w_t),$$

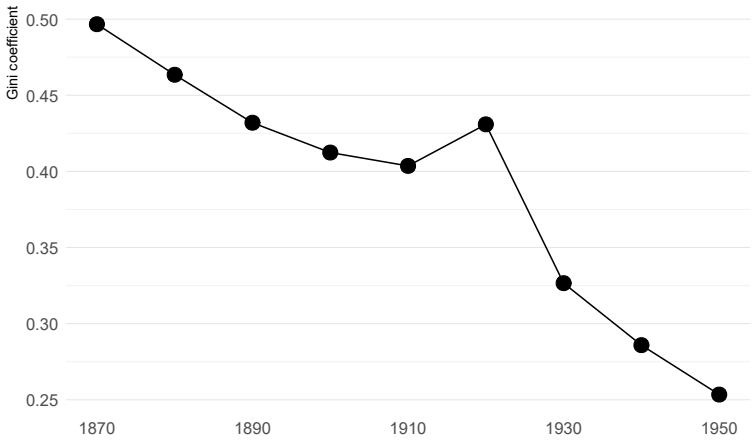
where y_t denotes the vector of group incomes and w_t the vector of group sizes (or employment weights). The change in inequality between years 0 and 1 is

$$\Delta G = G(y_1, w_1) - G(y_0, w_0).$$

Our baseline decomposition, shown in Figure 9, separates this change into an *income effect* and a *composition effect*. We first evaluate the counterfactual level of inequality that would prevail if group incomes were updated to their period-1 values while group shares remained at their period-0 levels:

$$G(y_1, w_0).$$

Figure 8: Gini coefficients of income, 1870–1950



Note: Calculations built on sample of taxpayers 1870, 1880, 1890, 1900, 1910 1920, 1940 and 1950, complemented with imputations for non-filers, and the Census for 1930. Corresponding Lorenz Curves are shown in Appendix Figure A.5.

This yields

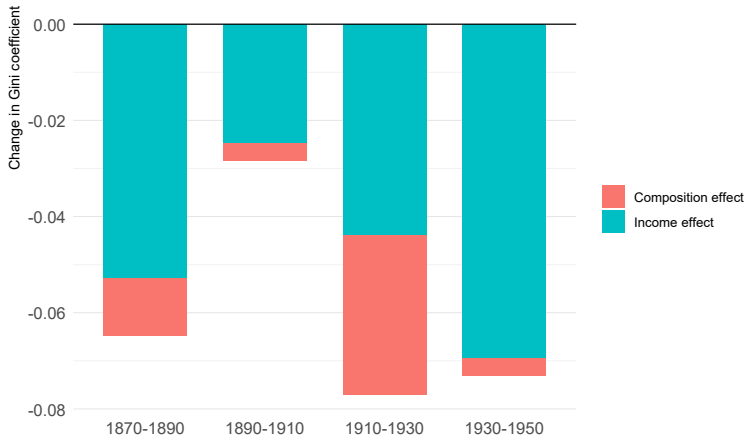
$$\Delta G = \underbrace{[G(y_1, w_0) - G(y_0, w_0)]}_{\text{income effect}} + \underbrace{[G(y_1, w_1) - G(y_1, w_0)]}_{\text{composition effect}}.$$

The first term captures the effect of changes in incomes holding the group structure fixed. The second captures the effect of changes in group shares holding incomes fixed at their period-1 levels.[13] In Figure 9, the income effect is illustrated in blue bars, and the composition effect in red bars.

The Gini coefficient shrank by 6.5 percent between 1870 and 1890, by 2.8 percent between 1890 and 1910, by 7.7 percent between 1910 and 1930, and by 7.3 percent between 1930 and 1950. In each period, the income effect – equalization of pay gaps – dominated the composition effect, contributing with 5.3, 2.5, 4.4 and 7.0 percentage points, respectively. It was only in the 1910 to 1930 period that the composition effect mattered greatly.

[13] A limitation of this decomposition is that it is path dependent: the estimated contributions depend on whether one lets incomes change before group shares, or vice versa. To address this issue, we also consider a Shapley decomposition, which averages over the two possible orderings. To estimate the Shapley decomposition we calculate income and composition effects in two different versions: one where incomes are changed first (and occupational shares held constant), one where occupational shares are changed first. The Shapley income effect is then defined as the average of the income contribution under the two orderings, and the same is done for the composition effect. The advantage of the Shapley decomposition is that it is symmetric and therefore not sensitive to the arbitrary ordering of income and composition changes. Using the Shapley decomposition, the income effects still dominate, but the relative contribution of composition changes becomes smaller 1910-1930 and larger 1930-1950. For a discussion of the problem of path dependency in decomposition analyses of inequality, see Fortin et al. (2011), pp. 25–27, and Shorrocks (2013).

Figure 9: Changes in the Gini coefficient decomposed into composition effects and income effects



Note: Decomposition of the changes in Gini coefficients demonstrated in Figure 8. The income effect is the counterfactual: what would have happened if occupational incomes would be changing, but occupational shares held constant to the baseline year (1870, 1890, 1910, 1930)? The composition effect is the opposite: what would have happened if occupational shares would change while occupational incomes would be constant.

7 Conclusions

Obviously, this is a very early first draft. However, some interesting results and some aspects that we would like to discuss further are the following.

Firstly, isn't the job upgrading between 1870 and 1910 surprisingly slow, or surprisingly non-existent? Our estimated changes by quintile in Figure 1 are really quite small for the two first subperiods, 1870 to 1890 and 1890 to 1910. Perhaps one could really say that the rapid GDP growth of this industrial golden age of Sweden was driven by simple jobs, not necessarily by refinement of the job structure.

Secondly, the role of agriculture throughout is quite fascinating. Here, especially the fact that the role of agriculture in job upgrading processes by no means can be reduced to shedding the low paid (or unpaid!) jobs of family assistants and agricultural labourers. Shedding these groups appears as completely central to the 1930 to 1950 period (the role of mechanization of agricultural labour should be discussed here), but in earlier periods, agriculture shed many quintile 3 and 4 jobs. Again, this must be complicated by considering the fact that these same jobs (semi-landless, small farmers, mid-size farmers) at the same time were experiencing a deterioration of their position in the income distribution (see Figures 3 and 5), meaning that the baseline year approach adopted here underestimates the positive side of the evolution. But it still appears as an interesting aspect to develop further in the next version of the paper – also given how the agricultural sector in contemporary studies (e.g. Bárány and Siegel, 2018) is dropped from the analysis, not playing any major role in the labour markets of rich countries today.

Thirdly, the improvement of the incomes of women after 1910/1920 is really striking (Figure 6), also in a comparative perspective. It appears that women were more deeply integrated in labour markets in Sweden early on (Molinder, 2023) and this aspect should be investigated further.

Fourthly, it is interesting and perhaps paradoxical that we find so much job upgrading (at least after 1910) and such a steep reduction of income inequality (Figure 8), but that the contribution of job upgrading per se to the shrinking of income differentials actually was rather small, and quite a lot smaller than the contribution of shrinking pay differentials (Figure 9). Why is the measured contribution of the composition effect so small?

A Appendix: Further figures and tables

The Appendix presents two alternative decompositions of the occupational upgrading – polarization calculations presented in Figure 1: first, by rural and urban residency, and then, by gender. It also provides detailed information on the largest occupations in the various benchmark years, and the position of these occupations in the income distribution. Finally, the inequality estimate presented in Section 6 is accompanied by the Lorenz Curves corresponding to the Gini coefficients previously presented.

A.1 Further decompositions: gender and urban/rural

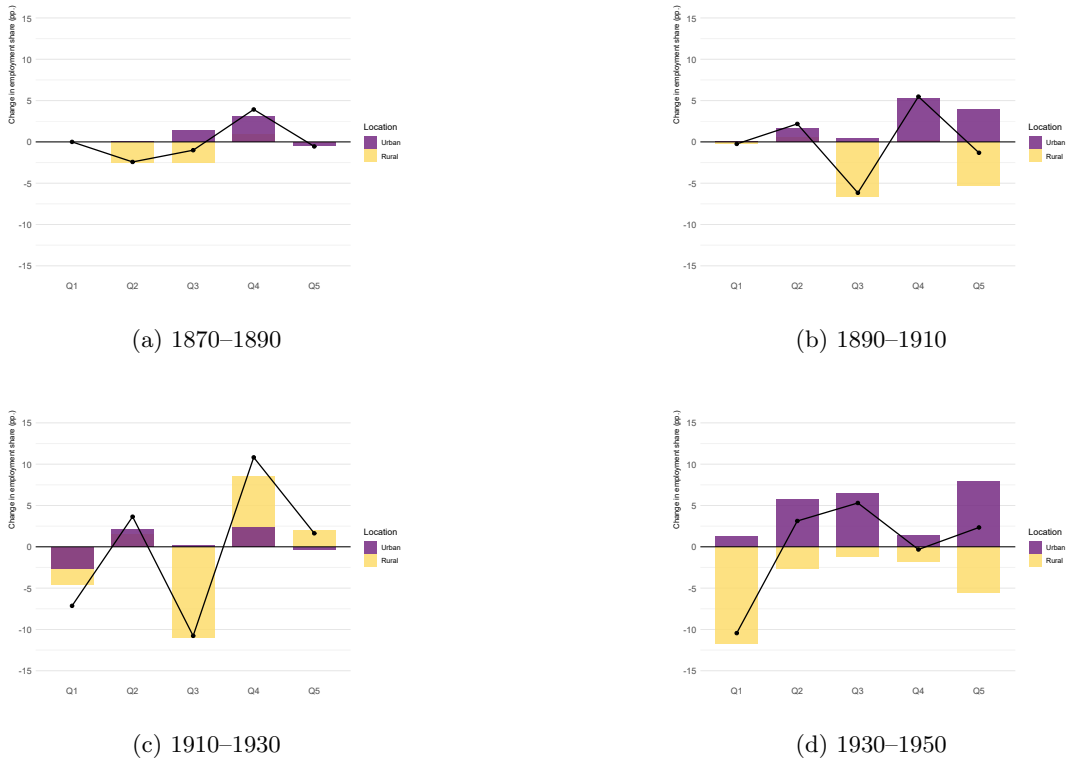
Figure A.1 shows the evolution of the job structure divided into rural and urban areas. These follow the administrative definition used in Sweden during the time period. According to these definitions, about 80 percent of the population lived in rural areas at the beginning of our time period. In our data, in 1870 14 sector of employment was in urban areas, in 1920, 34 percent, and in 1950, 61 percent. It is important to note that "rural" and "agricultural" are two distinct dimensions. There was a significant degree of industrial activity, and of course also some service sector jobs, in the countryside. (As an example, take the Census data from 1930 that we use. In this sample, 95 percent of agricultural jobs were in rural areas and 5 percent in urban areas, while the split for industrial jobs were 65–35, and for services, 59–41.) This means that the decomposition in Figure A.1 is distinct from the sectoral decomposition in Figure 2.

The decomposition by rural/urban residence does in itself possibly not reveal so much new compared to previous analyses in the paper. The 1870-1890 period still sees little change while the later three subperiods are marked by loss of jobs in the rural places and job growth in cities and towns. What is striking is perhaps that in 1890-1910 the urban labour market drives job upgrading (growth of quintiles 2-4 and no change in quintile 1) while the 1930-1950 period sees job growth in the urban sector across the board: quintile 2 almost as much as quintile 5.

Next, Figure A.2 divides the process by gender. It is important to note that Figure A.2 is a decomposition of Figure 1 by gender – i.e., the stacked bars of Figure A.2 will add up to the singular bars of Figure 1 – and not a decomposition of the female and male labour forces separately. The 1870-1890 and 1890-1910 plots do not say much of interest; the 1910-1930 and 1930-1950 processes are more interesting. In the 1910s and 1920s, women account for most of the job losses in quintiles 1 and 3 but also most of the job creation in quintiles 2 and 5. The upgrading of women's jobs in the interwar period corresponds to the well-documented expansion of clerical jobs available for women in this period (cf. Goldin, 1992; Bengtsson and Molinder, 2024; Neef, 2024). The 1930 to 1950 period is quite different: quintile 1 jobs of the 1930s shrink drastically (we know from Table A.6 that this is driven by family assistants in agriculture) while it seems that men enjoy growing middle-paying jobs (Q2, Q3) and men and women both experience upgrading as quintile 5 jobs grow.

To decompose the overall job polarization or upgrading into the contribution of men and women is not the only way to look at the gender aspect of the structural transformation. Figures A.3 and A.4 take a different tack: here, we instead begin by dividing the labour force into two

Figure A.1: Jobs polarization by urban/rural residence, 1870 to 1950



(a) 1870–1890

(b) 1890–1910

(c) 1910–1930

(d) 1930–1950

Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870, 1890, 1910 and 1950, augmented with Census employment information. The 1930 sample builds on the 1930 Census which uniquely includes income information. The analysis from Figure 1 has here been decomposed into the role played by urban and rural residents.

separate labour forces, one male and one female, and then analyze the evolution for each of these two fictional labour forces. The two sets of figures – Figure A.2 versus Figures A.3 and A.4 use related but conceptually distinct decompositions. Let $g \in \{m, f\}$ denote gender (men, women), let $q \in \{1, \ldots, 5\}$ denote income quintile, and let $t \in \{0, 1\}$ denote the beginning and end of a given period. Let w_{igt} be the employment weight of individual i of gender g at time t. Further, let $Q(i, t_0) \in \{1, \ldots, 5\}$ denote the quintile assignment of occupation i based on the *base-year* ranking used in the polarization analysis. The stacked gender bars in Figure A.2 decompose the change in the employment share of each quintile in the *total labour force*. Define total employment in year t as

$$W_t = \sum_{g \in \{m,f\}} \sum_{i} w_{igt},$$

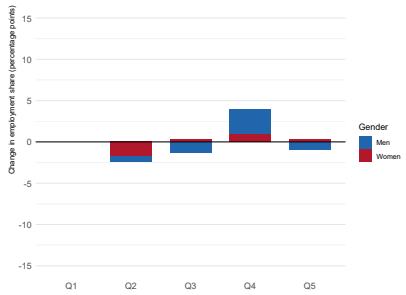
and the gender-specific share of quintile q in the total labour force as

$$s_{gqt} = \frac{\sum_{i:Q(i,t_0)=q} w_{igt}}{W_t}.$$

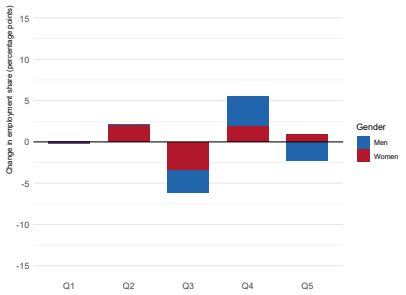
The total share of quintile q is then

$$s_{qt} = \sum_{g \in \{m,f\}} s_{gqt}.$$

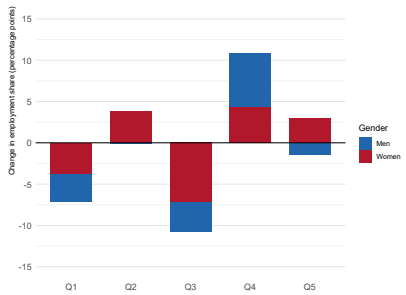
Figure A.2: Jobs polarization by gender, 1870 to 1950



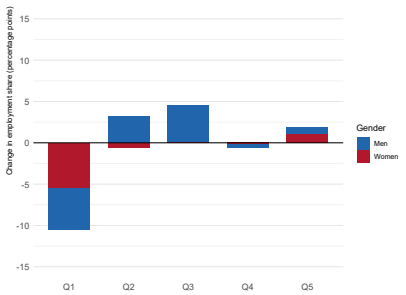
(a) 1870–1890



(b) 1890–1910



(c) 1910–1930



(d) 1930–1950

Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870, 1890, 1910 and 1950, augmented with Census employment information. The 1930 sample builds on the 1930 Census which uniquely includes income information. The analysis from Figure 1 has here been decomposed into the role played by men and women. Thus for example the observed decline for women in Q1 in 1930-1950 should be interpreted as: women account for roughly five percentage points of the decline in low-income employment (Q1) between 1930 and 1950.

Hence, the change in the total employment share of quintile q is

$$\Delta s_q = s_{q1} - s_{q0} = \sum_{g \in \{m,f\}} \left(s_{gq1} - s_{gq0}\right).$$

The stackedgender figures plot the two additive components

$$\Delta s_q^m = s_{mq1} - s_{mq0}, \qquad \Delta s_q^f = s_{fq1} - s_{fq0},$$

so that

$$\Delta s_q = \Delta s_q^m + \Delta s_q^f.$$

These figures therefore answer the question: How much of the total change in quintile q is accounted for by men and by women?

By contrast, the bars in Figures A.3 and A.4 treat the male and female labour forces as two separate entities. For each gender g, define gender-specific total employment as

$$W_{gt} = \sum_i w_{igt},$$

and define the share of quintile q *within gender* g as

$$\tilde{s}_{gqt} = \frac{\sum_{i:Q_g(i,t_0)=q} w_{igt}}{W_{gt}},$$

where $Q_g(i, t_0)$ is the quintile assignment constructed *within the male or female labour force separately* in the base year.

The plotted quantity is then

$$\Delta\tilde{s}_{gq} = \tilde{s}_{gq1} - \tilde{s}_{gq0}.$$

Since these shares are defined within each gender, they satisfy

$$\sum_{q=1}^{5} \tilde{s}_{gqt} = 1 \qquad \text{for each } g \text{ and } t,$$

and therefore

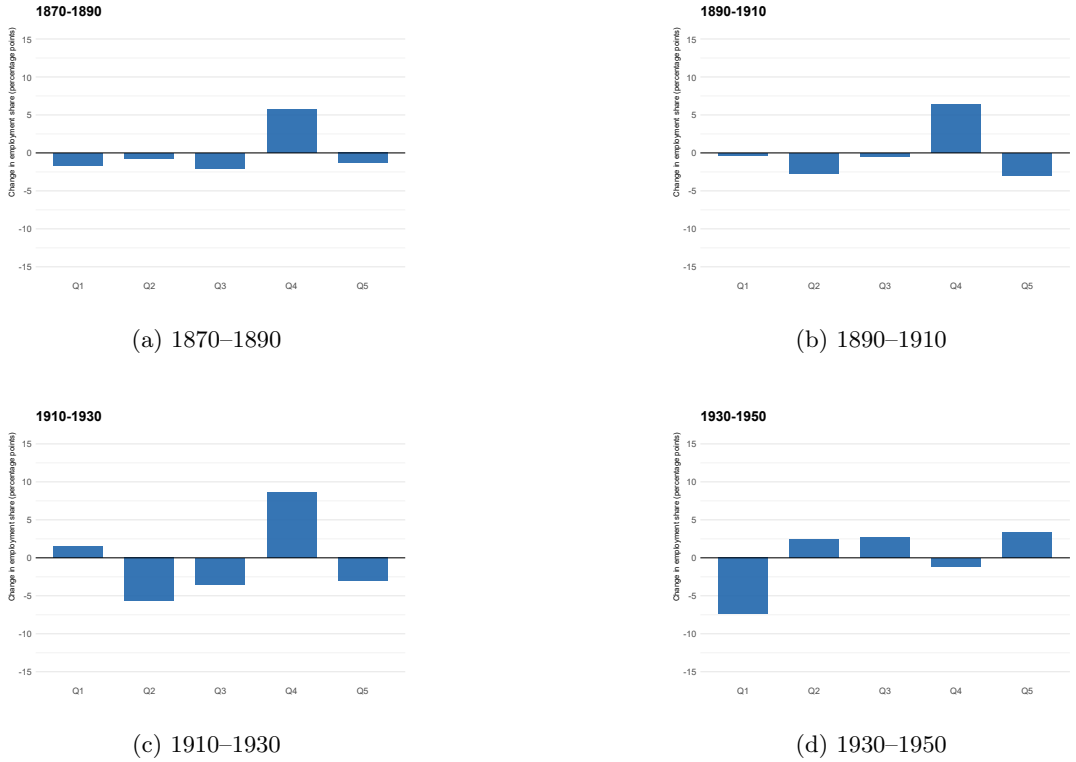
$$\sum_{q=1}^{5} \Delta\tilde{s}_{gq} = 0.$$

These figures answer a different question: How does the occupational structure of the male labour force change across quintiles? And how does the occupational structure of the female labour force change across quintiles? The distinction is crucial. In the stacked gender figures, men and women are measured relative to the *same total labour force*, and their contributions add up exactly to the aggregate change. In the separate figures, each gender is normalised by its *own* labour force, so the two figures are not additive and should instead be interpreted as two separate polarization analyses. Figures A.3 and A.4 drive home the point that from 1870 to 1890 very little happened for women in terms of jobs available, while men experienced some upgrading with the growth of Q4 jobs in the male labour force. The 1890 to 1910 period in a sense shows the opposite: upgrading for women (decline in Q2, growth in Q4 and Q5) but little happening for men. Finally, the 1930 to 1950 exhibits huge upgrading (and increased labour force participation?) for women, while men also enjoyed upgrading with a decrease in Q1 jobs matched by growth in quintiles 2, 3 and 5.

A.2 Detailed information on the occupational structure

An important diagnostic exercise is to break down the most common occupations, as we have defined them here (sector-class-subsector combinations) in relation to how large a part of the distribution they are. Table A.1 shows the 15 most common occupations (as we define them) in 1870 and where they range in the income distribution. They are sorted by mean income of the group, moving from the bottom to the top. It is immediately clear by comparing the "Previous cumulative" and "Post cumulative" columns that especially two occupations are gigantic (and poor). The first is the family assistants in agriculture. They are the bottom occupation of the income distribution and constitute 19.4 percent of all adults in Sweden this year! The second huge group is that of agricultural wage earners. They are even larger as a share of the population,

Figure A.3: Jobs polarization in the male labour force, 1870 to 1950



(a) 1870–1890

(b) 1890–1910

(c) 1910–1930

(d) 1930–1950

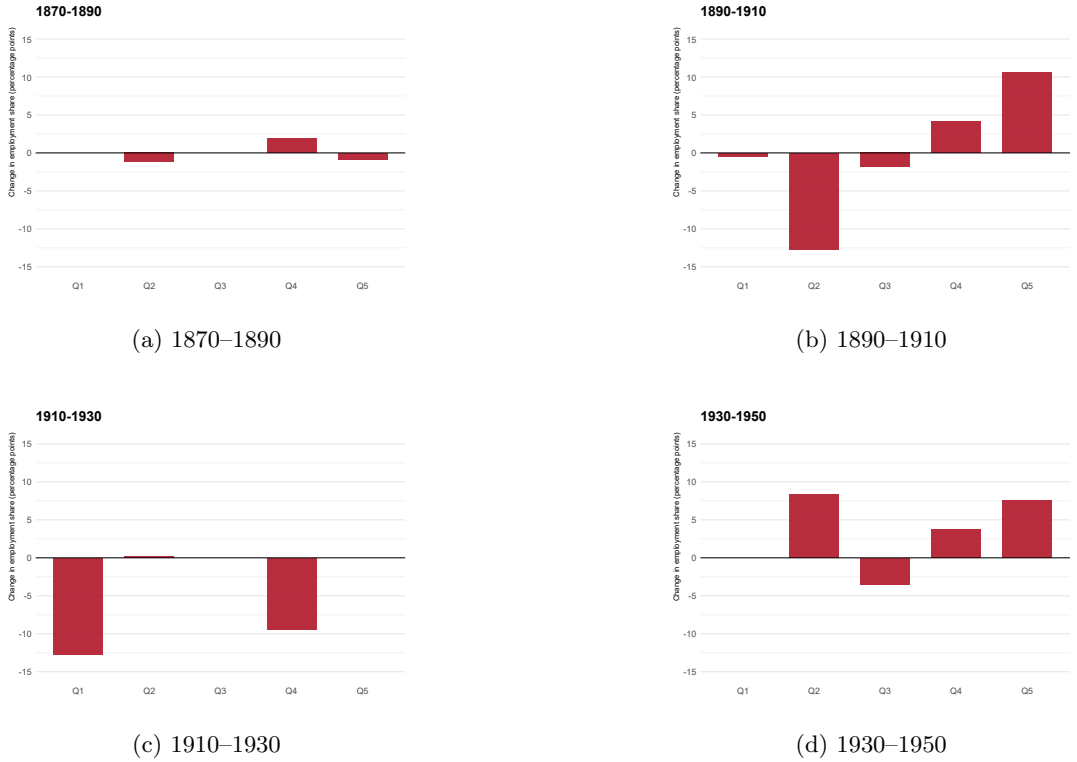
Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870, 1890, 1910 and 1950, augmented with Census employment information. The 1930 sample builds on the 1930 Census which uniquely includes income information. In this Figure only the *male* labour force is considered.

21.7 percent (41.1-19.4), covering the entire second quintile of the distribution in this year.[14] This is a problem for our job polarization analysis, as the occupations are so large. The other occupations are in this respect less problematic: about 5 percent of the employed are domestic workers, about 7 percent are semi-landless agricultural workers, about 6.5 percent are undefined labourers, and about 5 percent are farmers with middle sized farms.

Let us then move to 1890 and see if the problem with huge occupations has declined. Table A.2 shows that we still have two large groups that straddle the borders between income quintiles.

[14]The great size of these two groups raises other questions too, among them their gender composition. Family assistants in agriculture were in 1870 46.6 percent women, in 1890 46.8 percent, in 1910 47.2 percent, and in 1930 51.0 percent. That women do not dominate more, despite the well-known role of farmers' wives on farms in this period, attests to the role of adult (> 15 years) sons staying and working, unpaid, on the family farm. The role of family labour on Swedish farms in this period is discussed for example in the contemporary farm surveys by Nanneson (1923, pp. 24–29). In his analysis of a 1914-15 survey of a couple of thousand farms, Nanneson (1916, Table 8) estimates that on small farms, family labour was 82.5 percent of labour input, on mid-size farms with 15 hectares of arable, 36.3 percent, and on larger farms, less and less. The share of women in the group agricultural labourers was 41.7 percent in 1870, 38.2 percent in 1890, 34.4 percent in 1910, 8.4 percent in 1930 and 14.3 percent in 1950. The decrease over time probably reflects a real development as female agricultural labour was disproportionately replaced by machinery, but also, and this also goes in to the year-to-year fluctuations, leakage/porous borders between the groups agricultural labourers, undefined labourers, and servants. The group domestic workers (8.3.7) was 82.4 percent female in 1870, 91.7 percent in 1890, 93.5 percent in 1910, 83.6 percent in 1930, and 67.0 percent in 1950. General labourers of unknown sector (8.4.0): 21.1 percent, 29.3, 44.4 percent, 9.4 percent, and in 1950, 23.4 percent. Modalsli (2025, p. 7) also notes the problem with boundaries between the female-dominated labourer groups, observing in the Norwegian context that "it can be hard to distinguish those helping at home from those privately supported, and to some extent also from servants. For example, widows or unmarried women who run the household for relatives were reported as housekeepers (employed) in 1910, but as family members in earlier censuses".

Figure A.4: Jobs polarization in the female labour force, 1870 to 1950



(a) 1870–1890

(b) 1890–1910

(c) 1910–1930

(d) 1930–1950

Note: Builds on a 1/0.5 percent sample of bevillning income taxpayers in Sweden 1870, 1890, 1910 and 1950, augmented with Census employment information. The 1930 sample builds on the 1930 Census which uniquely includes income information. In this Figure only the *female* labour force is considered.

About 18 percent of the employed are family assistants in agriculture, straddling the first and second quintiles, and about 20 percent are wage earners in agriculture, straddling the second and third quintiles. Table A.3 shows that the problem has declined somewhat but is still present in 1910. The bottom 18 percent of the distribution are family assistants in agriculture, followed by 12 percent who are wage earners in agriculture. Beyond this, the largest group are the undefined labourers (10 percent, from percentile 34 to 44). By 1930 (Table A.4),family assistants were the bottom 9.5 percent of the distribution while the agricultural workers were the next 10.5 percent. This means that these two groups together constituted the entire bottom quintile, and another 0.08 percent of the distribution. Other larger groups included domestic workers, workers in textile industry, workers in metal industry, all around 5 percent of the labour force, and small farmers, about 6 percent of the labour force.

Another way of looking at structural change is to simply identify which occupations grow and shrink the most, defined in relation to the labour force as a whole. This is shown in Table A.5. In the 1870 to 1890 period, the three fastest growing occupations were wood working workers (8 2 4), transport workers (8 3 2) and textile workers (8 2 7). In the 1930 to 1950 period, the three fastest growing groups were salary earners of unknown sector (generic titles such as *tjänsteman*), retired people, and construction workers (8 2 9).

Conversely, Table A.6 shows the top 10 declining occupations of reach year. There are some truly drastic declines here. Between 1870 and 1890, the most dramatic decline was about 2.8 percent

Table A.1: Diagnostics: top 15 occupations of year 1870 and their place in the income distribution

Occ.	Occupation	N	Mean income	Previous cumul. (%)	Post cumul. (%)
9_1_1	Family assistants agric.	303 541	190	0.00	19.44
8_1_1	Wage earner, agric.	338 217	198	19.44	41.10
8_3_7	Wage earner, domestic	84 727	205	41.10	46.52
5_1_1	Semi-landless	111 690	271	46.52	53.67
8_4_0	Wage earner, undefined	112 938	281	53.67	60.91
8_3_6	Wage earner, admin/military	45 458	307	60.91	63.82
8_2_1	Wage earner, mining	14 997	316	63.82	64.78
6_2_7	Working owner, textiles	32 014	459	64.78	66.83
8_3_2	Wage earner, transport	20 359	485	66.83	68.13
4_1_1	Small farmer	144 932	843	68.13	77.41
13_4_0	Familial category	14 198	1021	77.41	78.32
3_1_1	Middle farmer	79 712	1403	78.32	83.42
7_3_6	Salary earner, admin/military	25 614	2058	83.42	85.06
6_3_1	Shop owner	26 424	2539	85.06	86.76
2_1_1	Large farmer	20 890	2789	86.76	88.09

Note: The table lists the 15 most common occupations in our dataset for 1870. The number of people employed in each occupation identified by our work with the Censuses is in the column headed N. The occupations' place in the income distribution is defined by the columns Previous cumul and Post cumul. which indicate the first and last percentile of the occupation. So for example, the middle-sized farmers cover the area of the distribution from the 78th to the 83d percentile.

of the employment structure and concerned the semi-landless. Other than the semi-landless, no group declined by more than 2 percent of the employment structure. In the other years we have more dramatic declines. Between 1890 and 1910, the agricultural workers decline by almost 8 percentage points (from 20.3 to 12.9 percent), and they decline by another point or so between 1910-1930 and 1930-1950. To little surprise the other group with gigantic declines are the family assistants in agriculture, a group which shrank by 7.5 percentage points of the labour force between 1910 and 1930 (from 18.1 to 9.5 percent) and then by another 9.5 percentage points (from 9.5 to 0.01 percent).

A.3 The income distribution described by Lorenz curves

Finally, Figure A.5 shows the Lorenz Curves of income as discusssed in Section 6. The Lorenz Curves in Figure A.5 correspond to the Gini coefficients shown in Figure 8.

Table A.2: Diagnostics: top 15 occupations of year 1890 and their place in the income distribution

Occ	**Occupation**	**N**	Mean income	Previous cumul. (%)	Post cumul. (%)
8_3_7	Wage earner, domestic	80 786	269	0.00	4.39
9_1_1	Family assistants agric.	339 203	272	4.39	22.81
8_1_1	Wage earner, agric.	373 341	291	22.81	43.09
8_4_0	Wage earner, undefined	139 542	367	43.09	50.67
8_2_7	Wage earner, textiles	35 121	369	50.67	52.58
8_2_4	Wage earner, wood industry	25 695	402	52.58	53.97
8_3_6	Wage earner, admin/military	47 306	427	53.97	56.54
5_1_1	Semi-landless	78 101	437	56.54	60.79
6_2_7	Working owner, textiles	36 392	471	60.79	62.76
8_3_2	Wage earner, transport	45 184	517	62.76	65.22
8_2_2	Wage earner, metals	27 017	521	65.22	66.68
4_1_1	Small farmer	176 355	1043	66.68	76.26
3_1_1	Middle farmer	94 312	1814	76.26	81.39
6_3_1	Shop owner	29 197	2157	81.39	82.97
2_1_1	Large farmer	24 752	3578	82.97	84.32

Table A.3: Diagnostics: top 15 occupations of year 1910 and their place in the income distribution

Occ	**Occupation**	**N**	Mean income	Previous cumul. (%)	Post cumul. (%)
9_1_1	Family assistants agric.	419 305	431	0.00	18.05
8_1_1	Wage earner, agric.	300 419	468	18.05	30.98
8_3_7	Wage earner, domestic	86 364	475	31.00	34.70
8_4_0	Wage earner, undefined	217 274	518	34.70	44.05
8_2_7	Wage earner, textiles	57 682	540	44.05	46.53
8_2_4	Wage earner, wood industry	47 154	543	46.53	48.56
5_1_1	Semi-landless	90 787	751	48.56	52.47
6_2_7	Working owner, textiles	52 791	785	52.47	54.74
8_3_2	Wage earner, transport	82 708	879	54.74	58.30
8_2_9	Wage earner, construction	67 874	960	58.30	61.22
8_2_2	Wage earner, metals	55 035	984	61.22	63.59
4_1_1	Small farmer	182 762	1721	63.59	71.46
7_4_0	Salary earner, undefined	37 468	2173	71.46	73.07
6_3_1	Shop owner	43 638	2753	73.07	74.95
3_1_1	Middle farmer	71 518	2777	74.95	78.02

Table A.4: Diagnostics: top 15 occupations of year 1930 and their place in the income distribution

Occ	**Occupation**	**N**	Mean income	Previous cumul. (%)	Post cumul. (%)
9_1_1	Family assistants agric.	322 417	394	0.00	9.53
8_1_1	Wage earner, agric.	357 193	850	9.53	20.08
8_3_7	Wage earner, domestic	168 891	874	20.08	25.07
13_4_0	Familial title	74 389	901	25.07	27.27
8_3_1	Wage earner, trade	122 588	1025	27.27	30.89
8_3_4	Wage earner, personal services	114 839	1073	30.89	34.28
8_2_4	Wage earner, wood industry	91 561	1127	34.28	36.99
8_2_7	Wage earner, textiles	152 156	1198	36.99	41.48
8_2_5	Wage earner, pulp and paper	63 975	1375	41.48	43.37
8_2_2	Wage earner, metals	157 077	1413	43.37	48.01
8_3_2	Wage earner, transport	147 705	1551	48.01	52.38
8_2_9	Wage earner, construction	152 912	1805	52.38	56.90
5_1_1	Semi-landless	101 639	1877	56.90	59.90
4_1_1	Small farmer	192 051	2341	59.90	65.57
3_1_1	Middle farmer	69 364	3718	65.57	67.62

Table A.5: Top 10 growing occupations by period (share of employment, %)

	1870–1890			1890–1910			1910–1930			1930–1950		
Rank	occ	s1	s2	occ	s1	s2	occ	s1	s2	occ	s1	s2
1	8 2 4	0.08	1.4	8 2 9	1.03	2.92	8 3 1	1.28	3.62	7 4 0	1.01	4.92
2	8 3 2	1.3	2.45	8 4 0	7.58	9.35	8 2 2	2.37	4.64	10 1 0	0.14	3.43
3	8 2 7	0.81	1.91	8 3 2	2.45	3.56	8 3 4	1.32	3.39	8 2 9	4.52	7.28
4	8 2 2	0.56	1.47	7 4 0	0.68	1.61	8 2 7	2.48	4.5	8 2 2	4.64	7.27
5	8 3 4	0.3	0.79	8 2 10	0.54	1.47	8 2 5	0.26	1.89	8 3 1	3.62	5.01
6	6 2 9	0.62	1.09	8 2 2	1.47	2.37	8 2 9	2.92	4.52	8 2 10	0.68	1.96
7	8 3 1	0.41	0.83	8 2 4	1.4	2.03	8 3 7	3.72	4.99	10 3 0	0.14	1.23
8	8 2 3	0.15	0.5	8 2 7	1.91	2.48	13 4 0	0.94	2.2	8 3 2	4.36	5.09
9	8 4 0	7.23	7.58	13 4 0	0.39	0.94	8 2 6	0.8	1.79	6 3 4	0.61	1.07
10	4 1 1	9.28	9.58	8 3 4	0.79	1.32	7 3 1	0.48	1.33	10 2 0	0.16	0.62

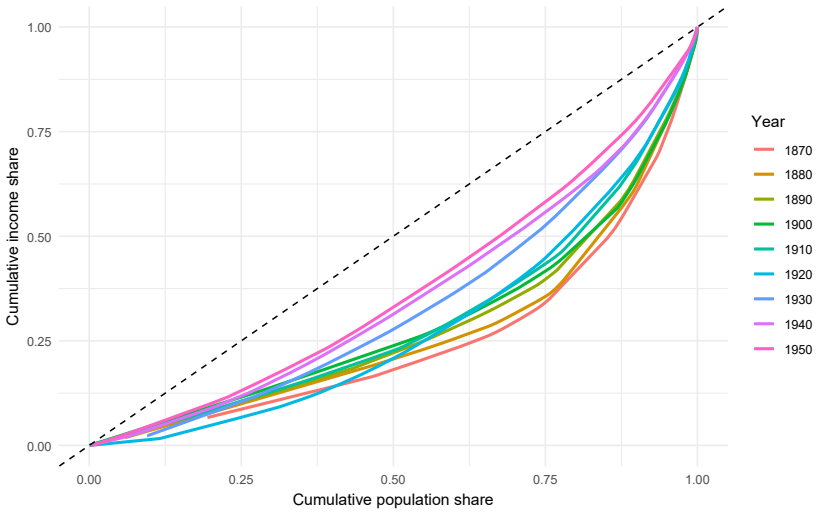
Note: The occupational code is a three-digit combination where the first digit is class, the second is broad sector, and the third is sub-sector. If the first figure is 4 it's small farmers, if it's 5 it's semi-landless, if it's 6 it's working owners or artisans, if it's 7 it's salary-earners, and if it's 8 it's wage-earners. The second digit, for broad sector, takes the value 1 for primary sector/agriculture, 2 for industry, 3 for services, and 4 for unknown. The third digit is more variable. The columns s1 and s2 show the share of the labour force being in the occupation at hand during the benchmark year and the following year: so in 1870 and 1890 in the first round, for example. The difference between s1 and s2 is then the growth of the occupation, measured in percentage points of the labour force as a whole.

Table A.6: Top 10 declining occupations by period (change in share of employment, %)

Rank	1870-1890			1890-1910			1910-1930			1930-1950		
	occ	s1	s2	occ	s1	s2	occ	s1	s2	occ	s1	s2
1	5_1_1	7.15	4.24	8_1_1	20.28	12.93	9_1_1	18.05	9.53	9_1_1	9.53	0.01
2	8_1_1	21.66	20.28	3_1_1	5.12	3.08	8_4_0	9.35	1.3	4_1_1	5.67	3.79
3	8_3_7	5.43	4.39	4_1_1	9.58	7.87	8_1_1	12.93	10.55	13_4_0	2.2	0.72
4	9_1_1	19.44	18.42	8_3_6	2.57	0.91	4_1_1	7.87	5.67	5_1_1	3	1.95
5	7_3_6	1.64	1.03	8_3_7	4.39	3.72	3_1_1	3.08	2.05	8_2_4	2.71	1.89
6	13_4_0	0.91	0.39	2_1_1	1.34	0.83	5_1_1	3.91	3	8_1_1	10.55	9.87
7	8_3_6	2.91	2.57	9_1_1	18.42	18.05	8_2_1	1.19	0.36	8_2_6	1.79	1.15
8	7_4_0	0.88	0.68	5_1_1	4.24	3.91	8_2_10	1.47	0.68	1_1_1	0.54	0
9	7_1_1	0.33	0.17	8_1_2	0.29	0.04	6_2_7	2.27	1.55	10_1_1	0.54	0
10	1_2_0	0.23	0.1	6_3_5	0.16	0.01	6_2_9	1.37	0.67	8_2_3	1.61	1.08

Note: The occupational code is a three-digit combination where the first digit is class, the second is broad sector, and the third is sub-sector. If the first figure is 4 it's small farmers, if it's 5 it's semi-landless, if it's 6 it's working owners or artisans, if it's 7 it's salary-earners, and if it's 8 it's wage-earners. The second digit, for broad sector, takes the value 1 for primary sector/agriculture, 2 for industry, 3 for services, and 4 for unknown. The third digit is more variable.

Figure A.5: Lorenz Curves of income, 1870–1950



Note: Calculations built on sample of taxpayers 1870, 1880, 1890, 1900, 1910 1920, 1940 and 1950, complemented with imputations for non-filers, and the Census for 1930.

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